

What is claimed is:

1. A treatment method of a semiconductor wafer, comprising:

treating the semiconductor wafer in a first solution including at least one kind of an oxidative acid and an oxidizing agent; and

treating the semiconductor wafer in a second solution including at least one of HF and  $\text{NH}_4\text{F}$ .

2. The treatment method of the semiconductor wafer according to claim 1, further comprising:

treating the semiconductor wafer in a third solution including at least one of an alkali, an oxidative acid and HF.

3. The treatment method of the semiconductor wafer according to claim 1, further comprising:

selectively etching the semiconductor wafer with a selective etching solution.

4. The treatment method of the semiconductor wafer according to claim 3, further comprising:

applying after-cleaning to the semiconductor wafer which has been subjected to the selective etching.

5. The treatment method of the semiconductor wafer according to claim 1,

wherein the second solution is an HF solution having a concentration of 33% to 49%.

6. The treatment method of the semiconductor wafer according to claim 2,

wherein the third solution is an alkaline solution including at least one of choline, ammonia water and KOH.

7. The treatment method of the semiconductor wafer

according to claim 1,

wherein the oxidative acid includes at least one of  $\text{HNO}_3$ ,  $\text{H}_2\text{SO}_4$ ,  $\text{H}_3\text{PO}_4$  and aqua regia, and the oxidizing agent includes at least one of  $\text{H}_2\text{O}_2$  and  $\text{O}_3$ .

8. A treatment method of the semiconductor wafer, comprising:

treating the semiconductor wafer in a first solution including at least one of  $\text{NH}_4\text{F}$  and  $\text{HF}$  whose concentration is 33% to 49%; and

treating the semiconductor wafer in a second solution including at least one of an alkali, an oxidative acid and  $\text{HF}$ .

9. A method of inspecting a semiconductor wafer which comprises a film constituting a device structure including a device pattern and which may have a crystal defect, the method comprising:

removing said film with a chemical solution to expose the crystal surface of the semiconductor wafer;

selectively removing a surface layer of the semiconductor wafer by selective etching to bring the crystal defect into view; and

quantitatively evaluating the crystal defect.

10. The method of inspecting the semiconductor wafer according to claim 9,

wherein said chemical solution includes a first solution having at least one kind of an oxidative acid and an oxidizing agent and a second solution having at least one of  $\text{HF}$  and  $\text{NH}_4\text{F}$ .

11. The method of inspecting the semiconductor wafer according to claim 9,

wherein said chemical solution includes a first solution having at least one of  $\text{NH}_4\text{F}$  and  $\text{HF}$  whose

concentration is 33% to 49% and a second solution having at least one of an alkali, an oxidative acid and HF.

12. The inspection method of the semiconductor wafer according to claim 9, further comprising:

removing contaminants produced on a surface of the semiconductor wafer due to said selective etching.

13. The inspection method of the semiconductor wafer according to claim 9, further comprising:

cleaning the semiconductor wafer so as to remove particles produced on the surface of the semiconductor wafer in the treatments up to said selective etching.

14. The inspection method of the semiconductor wafer according to claim 9,

wherein removing said film includes at least one execution of removing said film with a chemical solution composed of HF, H<sub>2</sub>O and an interfacial active agent, and of removing residuals through etching by use of H<sub>2</sub>SO<sub>4</sub>, H<sub>2</sub>O<sub>2</sub> and H<sub>2</sub>O.

15. The inspection method of the semiconductor wafer according to claim 9,

wherein said selective etching is carried out using one of a solution of chromic oxide (VI), fluorine, nitric acid, acetic acid and copper nitrate (II) trihydrate, a solution of chromic oxide (VI) and fluorine, and a solution of fluorine, nitric acid and acetic acid.

16. The inspection method of the semiconductor wafer according to claim 9,

wherein quantitatively evaluating the crystal defect includes:

creating in advance a reference area including a defect-free device pattern on the semiconductor wafer; and

detecting the crystal defect by obtaining an image to be evaluated which is an image of an area to be evaluated and a reference image which is an image of said reference area and comparing the image to be evaluated with the reference image.

17. The inspection method of the semiconductor wafer according to claim 16,

wherein said defect-free device pattern is formed by reducing stress.

18. The inspection method of the semiconductor wafer according to claim 17,

wherein a gate conductor or a contact is formed in the area to be evaluated and said stress is reduced by forming no gate conductors and no contacts in said reference area.

19. The inspection method of the semiconductor wafer according to claim 16,

wherein said area to be evaluated is formed in a process including irradiation of charged particles, and said defect-free device pattern is formed by avoiding or reducing damage due to irradiation of the charged particles in said reference area.

20. The inspection method of the semiconductor wafer according to claim 9, further comprising:

creating in advance a reference semiconductor wafer having a defect-free area in which the same pattern as the device pattern formed in the semiconductor wafer to be inspected is formed;

wherein quantitatively evaluating the crystal defect includes detecting the crystal defect by obtaining an image to be evaluated which is an image of an area to be evaluated and a reference image which is an image of the reference area, and comparing said image to be evaluated with said

reference image.

21. The inspection method of the semiconductor wafer according to claim 9, further comprising:

using a reference semiconductor wafer having a defect-free reference area in which the same pattern as the device pattern formed in the semiconductor wafer to be inspected is formed, so as to obtain in advance and store image information of the reference area;

wherein quantitatively evaluating the crystal defect includes obtaining an image to be evaluated which is an image of an area to be evaluated and a reference image which is an image of the reference area, and comparing said image to be evaluated with said reference image to detect the crystal defect.

22. The inspection method of the semiconductor wafer according to claim 9, further comprising:

exposing the semiconductor wafer to ultrasonic waves when removing said film with the chemical solution.

23. A method of developing a semiconductor device, comprising:

removing a film with a chemical solution, said film being formed on a crystal surface of a semiconductor wafer which may have a crystal defect, and said film constituting a device structure including a device pattern, so that the crystal surface of the semiconductor wafer is exposed;

selectively removing a surface layer of the semiconductor wafer by selective etching to bring the crystal defect into view,

quantitatively evaluating the crystal defect; and

optimizing a manufacturing process for the semiconductor device or the shape of said device pattern on the basis of information on the crystal defect obtained from said quantitative evaluation so that the crystal defect is

reduced.

24. The method of developing the semiconductor device according to claim 23,

wherein said chemical solution includes a first solution having at least one kind of an oxidative acid and an oxidizing agent and a second solution having at least one of HF and  $\text{NH}_4\text{F}$ .

25. The method of developing the semiconductor device according to claim 23,

wherein said chemical solution includes a first solution having at least one of  $\text{NH}_4\text{F}$  and HF whose concentration is 33% to 49% and a second solution having at least one of an alkali, an oxidative acid and HF.

26. A semiconductor wafer treatment apparatus, comprising:

a first device to remove with a chemical solution a film of a semiconductor wafer which may have a crystal defect, so as to expose a crystal surface of the semiconductor wafer, said film constituting a device structure including a device pattern; and

a second device to selectively remove a surface layer of the semiconductor wafer by selective etching to bring the crystal defect into view.

27. The semiconductor wafer treatment apparatus according to claim 26, further comprising:

a third device which removes contaminants produced on a surface of the semiconductor wafer due to said selective etching.

28. The semiconductor wafer treatment apparatus according to claim 26, further comprising:

a first monitor to observe particles in the chemical solution or in a cleaning liquid.

29. The semiconductor wafer treatment apparatus according to claim 26, further comprising:

a second monitor to observe a state of the semiconductor wafer in the chemical solution.

30. The semiconductor wafer treatment apparatus according to claim 26, further comprising:

a fourth device which removes particles produced on the surface of the semiconductor wafer due to said selective etching.

31. The semiconductor wafer treatment apparatus according to claim 26, further comprising:

a vibrator which generates ultrasonic waves to apply the ultrasonic waves to the semiconductor wafer.